

# Archives Preservation Policy

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# Archives Preservation Policy

## 1. Introduction

The purpose of this policy is to establish the principles used in the care and conservation of the archives held by the Royal Armouries. It reflects the broad range of materials making up the archives, including paper records, photographic materials, film and video, and audio-visual materials. The policy relating to the preservation of the Museum's born-digital and digitized records is currently being developed, and will be addressed in future revisions of this policy.

## 2. Relationships with other policies

This policy supplements the Care and Conservation Policy, which deals with the preservation of the objects in the Royal Armouries collection. There is a separate Disaster Plan to be followed in the event of fire, flood or other incident placing the Museum's collections at risk.

## 3. Aims

The aims of this policy are:

- to take all necessary steps to ensure the preservation of the archives, and to make them accessible for current and future generations;
- to meet the standards for the storage and exhibition of archival materials laid down in PD5454:2012;
- to take measures to slow the deterioration and prevent damage to the archival materials it holds; and
- to ensure that systems are in place to monitor repositories and galleries, and to take action to improve the state of environmental conditions, storage systems, packaging materials etc.

## 4. Statement of Authority

### 4.1. Guide for the Storage and Exhibition of Archival Materials (PD5454:2012)

PD5454:2012 provides detailed guidance on the nature of documents and best practice for their storage and use. It includes topics such as environmental controls for different media, protection against mould,

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infestation and pollution, environmental monitoring, environmental control, packaging and security. The guide also describes the repository building and measures that can be taken in the design and build of an archive facility. This section includes hazard avoidance, security, construction, environmental stability, fire and water protection, load distribution, shelving and lighting, to name but a few.

#### **4.2. Specification for Managing Environmental Conditions for Cultural Collections (PAS198:2012)**

PAS198:2012 provides a code of practice for developing a sustainable and strategic approach to Environmental Management for museums, archives and libraries.

#### **5. Survey, Planning and Review Cycle**

The Royal Armouries will carry out an annual survey of one of its repositories using the self-assessment checklist provided by Benchmarks in Collection Care. The results will be used to measure progress against the current Action Plan.

A major conservation audit and survey will be carried out every five years, and the results used to review progress against the previous survey, and to compile a new Action Plan for the next five year period.

#### **6. Conservation Department**

The Museum's Conservation Department will provide expert advice on the care and conservation of the archives.

#### **7. Environmental Control**

The Museum aims to provide the best environmental conditions in all of its repositories to ensure that the archives are not at risk of damage, and to guarantee their long term preservation. It will endeavour to provide appropriate control of temperature, relative humidity and lighting for all of the materials making up the archives, including paper records, photographic materials, film and video, and audio-visual materials, and electronic storage media.

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### 7.1. Paper records

Temperature		Relative Humidity		Lighting
Level	Fluctuation	Level	Fluctuation	Intensity *
18C	+2C	45-55%	+5%	50-200

### 7.2. Photographic materials

	Temperature		Relative Humidity		Lighting
	Level	Fluctuation	Level	Fluctuation	Intensity *
B/W negs and prints	<21C	+2C	25-35%	+5%	50 **
Col. negs and prints	<2C	+2C	25-30%	+5%	50 **
Glass plate negs	<21C	+2C	30-50%	+5%	50 *

### 7.3. Film & A/V materials

	Temperature		Relative Humidity		Lighting	Dust
	Level	Fluctuation	Level	Fluctuation	Intensity *	
Col. film	<2C	+2C	25-30%	+5%	50 **	
Magnetic tape (A/V)	18C	+2C	30%	+5%		<100,000

\* the effect of lighting is cumulative, that's why the number of lux has to be multiplied by the number of hours of exposure. Do not exceed 720 hours per year (8 hours per day during 3 months)

\*\* lighting has to be adapted to the fragility of the carrier.

### 7.4. Electronic storage media

	Temperature		Relative Humidity		Lighting	Dust
	Level	Fluctuation	Level	Fluctuation	Intensity *	
CD/DVD	20C	+3C	40%	+5	Very sensitive	<1,000

## 8. Packaging

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All Archives staff and volunteers will undergo training in the handling of archival materials, packaging, basic cleaning and minor conservation as part of their induction.

The Conservation Department will provide advice on appropriate packaging solutions for specific archival materials. In general archives will be packaged in appropriate containers made of conservation grade materials to prevent avoidable damage and extend the longevity of collections (see Appendix Two). Packaging will:

- protect from dust and handling grime
- protect from abrasion
- protect from distortion
- protect from accidental damage
- limit the effect of environmental changes
- act as a barrier to prevent the transfer of harmful chemicals e.g. acids and atmospheric pollutants
- restrict exposure to light
- provide support
- help to protect in the event of a fire or flood
- provide first hand evidence to stakeholders of how we care for our collections, and
- improve access and handle-ability.

## 9. Document handling

All Archives and Library staff will undergo training in the handling of archival materials as part of their induction to minimize the risk of physical damage from careless and inappropriate handling.

Library and Archives Reading Room staff will be responsible for ensuring that all researchers are made aware of the general regulations and guidance on using archives and special collections. Food, drink and ink are forbidden in the Library and Archives Reading Room. Researchers are permitted to take digital photographs, but any items for photocopying are inspected by staff, who may allow copies, make the copies themselves, or refuse copies. The Museum also offers a record copying service.

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## 10. Condition assessments

All Archives staff and volunteers, Library and Archives Reading Room staff will undergo training in assessing the physical condition of archival materials as part of their induction. A condition assessment should be carried out:

- before and after an item is requested by a researcher, and
- before and after an item is digitized, photographed or otherwise copied.

Any deterioration in the condition should be reported to the Archives and Records Manager and the Conservation Department.

## 11. Remedial conservation

The Conservation Department will be responsible for the approval of all external conservators and ensuring that the appropriate procurement procedures have been followed.

External conservators must either be accredited with ICON or work for a studio/company that is on the ICON Conservation Register, unless otherwise approved by the Conservation Manager. All external conservators will be expected to provide a condition report and treatment proposal that must be approved by the Conservation Department prior to any work being undertaken. Full documentation in line with the department's in-house style will be expected from all external conservators.

Appropriate contracts will be put in place with all external conservators or conservation studios/companies prior to work being carried out on objects belonging to Royal Armouries.

## 12. Review

This document will be reviewed annually and updates in corporate policy and plan, legislation and international conventions will be amended or added where relevant.

This document will be reviewed by the Archives and Records Manager and

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the Conservation Manager. and approved by the Director-General and Master of the Armouries.

**13. Risk Management**

The associated risk of non-compliance with this policy is:

Impact of non-compliance: High

Likelihood of non-compliance: Medium

**14. Effective date**

This policy is effective from the date of signing.

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Director General & Master of the Armouries

Date.....

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# Appendix One

## General principles on packaging

1. **Fitness for purpose** – packaging should provide adequate protection and support to prevent distortion, creasing, tears etc, but it should not add unnecessary bulk or weight
2. **Archival quality materials** that are designed to retain chemical stability and physical strength over long periods of time should be used.
3. **Items that are sensitive to high alkalinity** e.g. certain photographs, wool or silk, and some dyes and pigments, should be stored in unbuffered materials.
4. **Ease of access** and manipulation (inserting/extracting photographs for example) should be ensured.
5. **Ease of identification of documents** should be maximised. Labels on the outside of boxes and folders should be archival quality self-adhesive labels, and printed with permanent inks or written on clearly with pencil.
6. **Boxes should not be overfilled.** This can result in damage during storage and access.
7. **Maximum weight of a box** should be limited to 7 kg.
8. **Pins, clips and staples** should be removed from documents wherever possible/practical.
9. **Folder contents should be limited in size.** Where bundles are very large they should be split into smaller ones, preserving original bundle groupings and their original order.
10. **Original bundles must be preserved** wherever possible and the documents kept in their original order.
11. Where practical **smaller archive boxes** should be used to protect smaller documents from being damaged by larger items. This will also improve finding times and speed up production.
12. Wherever possible **similar sized items should be wrapped together.** This adds physical protection and support, and is an economical use of materials.
13. All **archival boxes** should make best use of space on existing shelves.
14. Where **folders** are used inside a box, they should be the same size and fit the box well.

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15. Packaged items should not be allowed too much movement as items with delicate surfaces (photographs, pencil drawings, parchment with flaking ink) can easily be damaged.
16. **Tying with tape should be avoided** for paper documents unless first protected with a strong inner support and wrapper. The knot should always be tied at the side (fore-edge of books) or top.
17. Items with **loose surface material**, such as flaking photographs or pastel drawings, should not be placed in contact with polyester as it carries an electrostatic charge and will further lift material from the surface.
18. **Folders with edge flaps** should be used to help prevent loss of smaller or multiple items.
19. **Individual newspaper cuttings** (ie not those stuck into albums or scrapbooks) should either be copied onto archival paper and the original cutting discarded, or be put in polyester sleeves with a backing sheet of alkaline paper or active micro-chamber paper.
20. **Book boxes** should be custom made or adapted to fit a book's dimensions exactly thereby avoiding abrasion damage/other damage from the book moving inside an overlarge box, and damage to the edges and joints of the cover if the box is too tight.
21. For **small volumes** (less than 2 cm thick), an individual enclosure such as a onepiece folded wrapper can be made.
22. If **books** can't be boxed, they should be wrapped in paper and/or tied up with a piece of board either side. The knot should be at the top or fore-edge of the book so that it does not dent it if placed under a heavier object.
23. **Large maps** should be stored rolled round the outside of a cylinder at least 200 mm longer than the width of the document rolled around it. The diameter should be such that it allows the document to lie flat when unrolled. The cylinder with the document rolled round it may be wrapped with a layer of cloth, which should be wide enough to overlap the edges of the cylinder and be tucked into the ends to exclude dust (alternatively linen bags or archival specification kraft paper or manilla could be used). This should be secured by tapes at least 25 mm wide.

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24. **Works of art/other documents with delicate surfaces** etc, should be hinged onto a supporting board and window mounted with a cover, or put into a four-flap folder.
25. **Pendant seals** should be packaged to support the attachment as well as the seal inside a folder.
26. Specific requirements are necessary for certain materials, for example magnetic media requires avoidance of *magnetic fields* and therefore steel; **degraded film** negatives need cold storage; and **glass plate negatives** with the combined weight and fragility of glass need packaging that prevents movement and contact.

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# Appendix Two

## A) Paper Documents and Artworks

The following is based on the guidance published by the National Archives of Australia.

This advice is for collection items such as:

- letters and certificates
- newspaper and magazine clippings
- prints and posters
- drawings, watercolours and paintings.

Paper-based materials can deteriorate chemically and physically. Some deteriorate because of their inherent properties, others as a result of poor storage or display conditions. Damage can be caused by poor handling practices. The media on paper-based objects, such as ink, watercolour or pencil can also degrade. While we cannot stop deterioration, we can influence the rate at which it happens.

### 1. Deterioration

#### 1.1. Chemical deterioration includes:

- fading and discolouration of papers and the media on the paper caused by exposure to light or ultraviolet (UV) radiation. Deterioration will occur more quickly when exposed to higher light intensity.
- deterioration caused by mould attack that can develop in humid conditions; mould has the ability to consume and stain the materials on which it grows.
- paper brittleness and staining caused by acid either in the paper or the material with which the paper is in contact.
- deterioration caused by interaction between the paper and the printing medium used. Iron gall ink is acidic by nature and over time, can burn through the paper on which it is written.

#### 1.2. Physical deterioration includes:

- handling and use damage such as, tears, dents, punctures, abrasions, and paper losses.

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- folds and creases causing paper to split.
- pest attack, caused by some insects and rodents for which paper and glues are a food source.
- extreme temperature and relative humidity fluctuations that cause buckling and distortion.

**Correct handling** of flat paper items will aid their long-term preservation. The following procedures should be followed:

- always handle with care.
- never allow food or drink near items
- have clean hands, even when wearing protective cotton or powder-free surgical gloves. If an object is particularly fragile close-fitting surgical gloves may be more appropriate.
- use a rigid support, such as piece of cardboard when carrying papers. This is important where papers are oversized and fragile or need to be carried over long distances.
- a flat-bed trolley is useful for moving oversized material.
- interleave artworks and documents with archival tissue to protect them from abrasion and ink or adhesive transfer from other items.
- when working with artworks, use pencil not ink. Pencil marks are readily removed, whereas inks can be difficult or impossible to remove.

## 2. Preservation and storage

### 2.1. Environment

If specialised storage is available then temperatures between 18 to 20 °C and at relative humidity between 45 to 50 per cent are desirable. Office air-conditioning generally operates between 21 and 23 °C in temperate climates. If these conditions are stable then the natural deterioration of the objects can be moderated. Wide fluctuations in conditions can physically stress records and accelerate their deterioration. Note that air-conditioning systems usually only operate during office hours, leading to a wider fluctuation of temperature and relative humidity at other times. At sustained relative humidities over about 65 per cent, mould growth can occur. It is recommended that you aim for a storage area with stable conditions, where the temperature is around 20 °C and the relative humidity remains below 60 per cent.

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Corrugated board storage boxes can provide a convenient micro environment by buffering documents from the full effects of fluctuating humidity and temperature.

Materials degrade more quickly when exposed to light, especially ultraviolet (UV). Surprisingly, fluorescent tubes often emit a relatively high level of UV. Lighting should be turned on only when it is needed. Ideally, storage areas should have no windows. Where windows are present, they should be covered with opaque curtains or blinds.

Insects and rodents will cause damage through what they eat or leave behind. Reduce the chance that they will be attracted to record storage areas by following these recommendations:

- do not eat in storage areas.
- keep surfaces (floors, tops of shelves) clean.
- empty rubbish bins regularly.
- check storage areas regularly for outbreaks of insects or rodents. Should an infestation occur, baiting or fumigation may be necessary.

## **2.2. Shelving**

Use properly cured powder-coat painted metal shelves for paper records and plan cabinets for flat storage of maps, plans and large artworks. Prints, drawings, posters and watercolours should be stored flat, while paper files are usually stored vertically. Clearly label storage boxes and folders to minimise unnecessary handling. The storage area and facilities should be clean to discourage pests. Unsealed wooden and particle board/MDF shelving can release harmful vapours and should be replaced where possible.

## **2.3. Packaging**

Simple archival enclosures such as boxes, folders, wallets and paper cards protect paper based items against mechanical damage, light and dust. They also provide micro-environments that reduce temperature and relative humidity fluctuations.

Choose a high-quality paper product for long-term storage. Some plastics are also suitable for paper record storage. The plastic should be free of plasticisers, surface

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coatings and other harmful chemicals. The most suitable plastic film is a form of polyester known as PET, which sells under the proprietary names Mylar or Melinex. Food grade polypropylene and polyethylene are acceptable lower cost alternatives.

Encapsulation is a method of storage that uses a close fitting stiff polyester sleeve to take the majority of handling pressure and abuse. It allows an item to be viewed in its housing without direct contact. Hot lamination where the plastic sleeve is adhered to the original documents and artworks **is not** recommended. This treatment is irreversible and will lead to the accelerated deterioration of the paper inside.

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## B) Paper Files

The following is based on the guidance published by the National Archives of Australia.

This advice discusses the particular problems associated with the protection and handling of files.

A file is a collection of documents on a similar subject or transactions held together in a folder. The documents within the file are often fastened together in smaller numbers using staples, paperclips or pins.

The types of documents on a file can include:

- maps and plans
- photographs
- documents and artworks on paper
- photocopies and laser prints
- thermal papers

### 1. Deterioration

It is important to understand how paper deteriorates because all the materials on a file are usually paper-based.

Paper is mostly made up of cellulose fibres derived from plants. In the past hundred years a lot of the paper has been either acidic or contained impurities that produced acids. Over time, this caused the paper to discolour and embrittle. Newspaper and paperback books often show this deterioration. More recently, standard paper grades are being manufactured using an alkaline process that produces a paper with a much better life expectancy.

Production method alone does not produce a high quality paper. Other factors including the quality and type of fibre stock, the additives and impurities incorporated influence the quality of paper produced.

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**Recycled paper** is not considered archival and should not be used for records that are to be permanently retained. Recycled paper may contain impurities such as printing inks and plastics from toners used in copiers and the processing also shortens cellulose fibres, reducing paper strength and durability.

**Thermal paper** has been used for older fax machines, electronic whiteboards and payment dockets. The paper has a heat-sensitive chemical coating that holds the printed image. Unfortunately, the image can quickly be affected by friction, heat or light. Contact with certain materials such as highlighter pens can dissolve the image. To preserve the information on thermal paper it should be *photocopied*.

**Carbonless copy paper** as the name suggests, is a copy produced without the aid of a separate carbon paper. Typically, carbonless copy papers are used for such things as freight dockets and stationery requests. The printed images on these papers are highly unstable and can fade quite rapidly. Carbonless copy paper should be photocopied onto plain paper for long-term information retention.

## 2. Preservation and storage

Careful handling is the essential basic strategy for the long-term preservation of paper files:

- ensure your hands are scrupulously clean and free from food, grease and hand creams.
- take care when using pens near archival records, because they can leave indelible marks on pages.
- turn pages carefully, with two hands if necessary, to avoid tearing pages off the file pin.
- do not use a wet finger to turn pages.
- if you need to bookmark a page in a file use a piece of clean white paper – avoid using 'post-it' notes and remove the 'bookmark' when finished.
- do not use adhesive tape to repair tears. It will discolour, damage the paper and eventually fall off.

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- polyester, polyethylene or polypropylene plastic sleeves are very useful for placing torn or detached folios back on files and isolating photographs and other materials from adjoining file pages.
- file pins and other metal pins will eventually rust. Use stainless steel pins and clips or plastic clips to fasten files. Placing a piece of archival quality paper between the clip and the document will prevent damage to the paper.

If folios are protruding from files then the papers should be carefully re-aligned. Before placing files in protective packaging it is important to ensure that they are free of dust and unaffected by mould, insects, or active deterioration. Affected items should be isolated and advice on how to deal with them sought.

- every item, or group of items, should have a file cover or protective material enclosing it.
- cotton tape can be used to bundle loose papers.
- Do not fold items to fit them into the file cover. Provide a covering that suits the size of the item and place it in a suitably sized box.
- all packaging materials should be made of archival materials. You can slow the deterioration of acidic paper by storing it in alkaline packaging.

The way in which files and general papers are arranged in boxes is very important:

- files should be stored on their spine with the file pin at the bottom of the box.
- where a file only consists of individual documents or items and they can be stored flat on the bottom of a box – take care not to stack too many items on top of one another or retrieval may be difficult and damage items at the bottom.
- thin items stored on their edge must be supported to avoid the paper curling and sagging.
- cards are usually stored upright in lidded boxes. They should be packed densely – but with enough space to allow a search for individual items. Use cotton tape rather than rubber bands to hold cards together.
- make sure the box is the correct size for the records to allow for easy retrieval and reduce the likelihood of handling damage.

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- it is preferable not to stack boxes. However, if necessary they should be stacked in a staggered formation not more than four high, with the boxes at the bottom filled to avoid collapse.

Storage shelves and cupboards should be designed and set out to minimize damage to any stored items:

- shelves should be powder-coated metal or wood with an inert coating to prevent the release of harmful organic vapours.
- the lowest shelves should be 15cm off the floor in case of minor flooding.
- paper records should not be stored on the top of shelving units. Files may be too close to ceiling lights and exposed to dust and in the event of fire, water damage from fire sprinklers.
- aisles between shelving should allow easy access to, and transport of records.
- suitably sized tables should be located near storage cabinets, so that staff can safely check the contents and retrieve items from boxes and drawers.

Storage drawers should be clearly labelled with their contents so that items may be retrieved with a minimum of handling.

To prevent damage to the items, ensure that the drawers:

- operate smoothly when opened and closed
- have stops to prevent them being pulled completely out when they are opened
- have a lip at the front to prevent items from falling onto the floor and one at the back to prevent them from falling behind the drawers
- are never overfilled.

Paper documents should be stored in the same environment recommended for paper records and artworks.

Pests such as insects and rodents can be attracted to record storage areas in search of food and shelter. They may take to eating paper-based material such as files.

To reduce the possibility of pest damage:

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- keep the area clean – dust can be a breeding ground for insects and mould.
- do not eat or drink in storage areas, as food scraps attract pests.
- check storage areas regularly for insect or rodent outbreaks. Baiting or fumigation may be necessary if there is an infestation.

Files are usually identified by writing on the file cover. Documents may be folioed in pencil, placed in a labelled box. Clear labelling, will reduce the amount of handling an item receives.

### 3. Copying

Photocopying is often used as a generic term for electrostatic printing. Strictly speaking, the term photocopy refers to photographic copy processes used until the 1960s. However, for consistency the term photocopy will be used in these preservation advices in place of the more correct technical terms – electrostatic or laser printing. The most common office copying process is photocopying with an electrostatic or laser printer where paper reference copies are required. These prints are generally low resolution reference copies.

Digital file scanning can be used to produce high resolution digital files that are required for preservation and access.

Document copying may occur for several reasons:

- to preserve a copy of the information on a fragile or deteriorating record
- as an access copy to preserve a heavily used original record
- to exhibit a copy and preserve the original record in storage.

When copying archival records, the following points should be considered to ensure that the record is not damaged:

- ensure that the copier platen is clean, and dry the platen if cleaning is required.
- don't use document feeders for archival documents.
- refer a record to a conservator before copying if it is in poor condition.
- consider using a scanner when copying an original photograph since it is safer and can provide a much better image quality. Do not apply pressure to the

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back of a mounted photograph, since this could crack or break the mount and photograph. If possible, copy a reference print.

- before copying an archival file, it should be disassembled and all metal clips, staples and pins carefully removed. The file should be reassembled in the same order afterwards.
- documents that are slightly creased and/or folded may be smoothed out by carefully pulling the wrinkles flat – severely creased, folded or torn items should be treated by a conservator before copying.
- digital scanning should be used where high image quality and multiple digital or hard copies are required.

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# Appendix Two

## C) Archival Files

The following is based on the guidance published by the National Archives of Australia.

In the field of archival records the term 'volume' describes an item in the form of a bound book. Volumes may be bound in a variety of styles and materials to protect the pages inside:

- a case bindings is where the cover is made separately and wrapped around the text block like common paperbacks and hardbacks. They can include fine, decorative or limited edition volumes where the binding is also considered to be significant. Large leather or suede bound 19th century ledgers and registers are other common examples found in archives.
- logbooks and diaries, usually with simple binding structures, often hand-written manuscripts. They vary in size and quality.
- simple do-it-yourself bindings such as comb or spiral bindings used for business and government reports, diaries and one-off documents
- loose-leaf binders and folders that allow individual leaves to be easily added or exchanged
- post bindings use a number of metal posts or screws to hold the binding and the text block together. The post may or may not be designed to unscrew to add pages. Photograph albums often use this structure.

All the materials listed above are prone to deterioration over time:

- some papers become brittle.
- parchment, used for historic documents and occasionally for binding is un-tanned leather that is very moisture sensitive – cockling and growing mould when damp, cracking when dry.
- leather is susceptible to becoming powdery and developing 'red rot'.
- paper, textiles and leather are susceptible to mould growth in humid conditions.
- metals corrode
- adhesives age and become brittle, losing their tack and can discolour.

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Damage will commonly be caused to volumes by misuse or careless handling:

- Spines can be broken by opening the volume too far.
- If the stitching and materials holding the volume together are split, broken or torn. The bindings can break down and pages and covers become detached.

## 1. Preservation and storage

Protective packaging and labelling, appropriate storage environment, pest control and copying are practical measures that will minimise this deterioration.

When handling volumes the following steps should be taken:

- remove the volume from the shelf by holding the centre of the spine.
- if necessary, gently push the items either side into the shelf so that the required volume protrudes.
- do not by place a finger at the top of the spine and pull the volume from the shelf – this will lead to the spine being torn from the book.
- carefully carry single volumes. However, when moving heavy volumes or more than one volume, use a trolley.
- when opening a volume, lay it on a clean flat surface. Open the volume gently, without forcing the spine down flat and support it with a cushion.
- take care not to drag the volume across surfaces as this will scratch the cover.
- fragile volumes should be supported when open. Raised boards under each cover in a 'V' shape reduce the stress put on the binding.
- don't repair pages or spines with adhesive tape. If the covers are loose or detached tie the volume – like a present – with cotton tape. Seek professional advice for a more permanent repair.
- only clean volumes with a very soft, wide brush (such as hake brushes available at art supply shops).
- some old ledger covers are prone to deterioration of the leather binding, known as 'red rot'. This is believed to result from the combined action of air pollution and poor leather manufacturing processes. The telltale sign is red dust on fingers when the volumes are handled. An effective temporary measure is to place the volume in a plastic bag to contain the leather dust.

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The size, weight and volumes binding structure can make photocopying difficult and damaging. If copying cannot be avoided, consider the following points:

- take time to carefully place the volume on the platen and don't force the spine down flat.
- don't force the copier lid down to flatten the volume. Cover it with a piece of card while on the copier.
- carefully lift and close the volume when the copying is completed.

It may be more satisfactory to capture the volume pages with a purpose designed book copier or a digital camera on a copy stand. Specialist advice should be sought through the Agency Service Centre before copying old and fragile volumes.

Volumes are usually protected by their binding and can be placed on shelves without boxes. However, to protect the binding and make retrieval easier volumes can be housed in boxes. Some volumes have decorative bindings that must be protected from dust and dirt by being boxed or wrapped in archival paper.

Before placing a volume on a shelf or in protective packaging, it is important to ensure that it is free of dust and unaffected by mould, insects or active corrosion in metal fittings. Affected volumes should be isolated and advice on how to deal with them sought through the Agency Service Centre.

Clear labelling of volumes is a very important aspect of preserving them. If volumes are easy to find, it reduces handling and the chance of damage.

A label can be adhered to a binding that is not intrinsically important. However, the adhesive on the label is likely to stain the cover, eventually fail, and have to be replaced. A better solution is to have an inert plastic strip, or plastic cover, made to fit over the cover and have the label attached to that inert plastic strip or cover.

Storage furniture should be designed and set out to minimize damage to any items that are stored within it:

- shelves can be powder-coated steel or wooden, with an inert coating.

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- the lowest shelves should be 15 cm off the floor in case of minor flooding.
- records should not be stored on the top of shelving units. Files may be too close to ceiling lights and exposed to dust and in the event of fire, suffer water damage from fire sprinklers.
- large fragile volumes that won't close properly – containing paper cuttings or photographs – should be stored flat on shelves.
- store smaller volumes upright on shelves and where possible provide support with shelf dividers at regular intervals. If volumes are allowed to lean then the binding will be stressed and damage is likely. This also applies to volumes in protective boxes.
- be aware that protective boxes may be required for some types of binding – such as post binding that may protrude and damage adjacent volumes.
- boxes and any other packaging materials should be made of archival materials.
- aisles between shelving should be wide enough to allow easy retrieval and transport of records.
- position suitably sized tables near storage cabinets to allow staff to safely check contents and retrieve items from boxes and drawers.

If specialised storage is available then temperatures between 18 to 20 °C at a relative humidity between 45 to 50 per cent are desirable. Office air-conditioning generally operates between 21 to 23 °C in temperate climates. If these conditions are stable then the natural deterioration of the objects can be moderated. Wide fluctuations in conditions can physically stress records and accelerate their deterioration. Note that air-conditioning systems often only operate during office hours, leading to a wider fluctuation of temperature and relative humidity at other times. At sustained relative humidities over about 65 per cent, mould growth can occur. It is recommended that you aim for a storage area with stable conditions, where the temperature is around 20 °C and the relative humidity remains below 60 per cent.

Materials degrade more quickly when exposed to light, especially ultraviolet (UV). Surprisingly, fluorescent tubes often emit a relatively high level of UV. Lighting should be turned on only when it is needed. Ideally, storage areas should have no windows. Where windows are present, they should be covered with opaque curtains or blinds.

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Pests such as insects and rodents can be attracted to record storage areas in search of food and shelter. For such organisms, volumes, with their leather covers, cellulose pages and starch or protein adhesives, are a very attractive food source. To reduce the possibility of pest damage:

- keep the area clean
- do not eat in storage areas as food scraps can attract pests.
- check storage areas regularly for outbreaks of insects or rodents – should an infestation occur, baiting or fumigation may be necessary.

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# Appendix Two

## D) Maps and Plans

The following is based on the guidance published by the National Archives of Australia.

There are a variety of methods for producing maps and plans:

- hand-drawn maps and plans – prepared using inks, pencil, crayons and watercolour paints
- computer-drawn maps and plans – transferred to a hard copy of paper or film, using a line printer
- photoduplicates – made using processes such as blue print, electrostatic duplicating, diazo, and photographic processes
- printed maps – created using modern printing techniques such as offset.

They are created on a range of materials:

- tracing and offset papers
- photosensitive papers and synthetic papers
- plastic film and tracing cloth, which are often used for architectural and engineering plans.
- paper plans are often mounted to fine linen to strengthen them for handling

### 1. Preservation and storage

Deterioration of materials over time is inevitable, but we can control how fast it happens. Some materials are susceptible to deterioration because of their composition and others as a result of storage conditions.

- some types of translucent tracing paper are acidic and deteriorate more quickly because of their manufacturing process.
- thin papers backed with cloth are sometimes damaged because the cloth and the paper react differently to changes in relative humidity and temperature. The paper may fracture or separate from the cloth, because of the tensions built up between the paper and the cloth backing.
- starch-filled tracing cloth may be affected by moisture and mould.

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- oiled cloth and paper can become rancid.
- diazo prints may turn yellow or brown over time. This is due to a reaction between the chemicals used to develop the image and oxygen in the air. Store these records away from light and copy them to another medium if they contain information of long-term value.

Correct handling of maps and plans will aid their long-term preservation:

- the large format of many maps and plans can make them difficult to handle and easy to tear.
- large format records should be transported flat, supported on an oversized sheet of paper, cardboard or inside a plan folder. These records are often found rolled up and sometimes folded. Folding maps or plans will damage them. If a large format record must be kept in a file, then copy it and put the copy in the file. Store the original plan flat elsewhere.
- if it is necessary to roll them for storage or transport: roll each item around a cardboard tube, longer than the record and at least 90 mm diameter. Use a protective paper wrapping around both the tube and the map/plan.
- when moving large unwieldy items, use flatbed trolleys to fully support them and allow enough flat space for their viewing.
- carefully unroll large format records, distributing pressure and using long weights to hold the curled ends down. If the curl in the paper is very strong it may need humidifying first and in such a case it is recommended that you seek professional guidance.
- do not use adhesive tape to repair tears.
- plastic heat lamination is irreversible and should never be applied to archival records.

Ensure that large format records are free of dust and unaffected by mould or insects before repackaging or placing them in storage. If you find maps, plans and charts with these problems, isolate them and seek advice through the Agency Service Centre.

Protective packaging for maps, plans and charts includes the following options:

- polyester, polypropylene or polyethylene sleeves – polyester is a tough transparent plastic and polypropylene and polyethylene are cheaper

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alternatives (if choosing polyethylene, choose a plastic that is around 100 microns thick) – both support plans and protect them from dust and handling damage.

- interleaving with archival paper sheets protects the records from abrasion, ink or adhesive transfer from other plans.
- folders that are as large as the plans to provide support and reduce handling of individual records in the drawer.
- label maps and plans by writing on the back of the item with a soft pencil or if they are individually bagged, attach the label to the sleeve.
- accurately list contents on folders and the drawers to minimise handling.

To prevent damage to the records when the drawers are opened and closed the drawers should:

- be fully functional and operate smoothly
- have stops to prevent them from being pulled completely out when they are opened
- have a lip at the front to prevent items from falling onto the floor and one at the back to prevent them from falling behind the drawers
- never be overfilled. Folders should contain no more than about twenty plans. This will ensure that each folder is a manageable size for safe handling.

Other considerations when storing maps and plans are as follows:

- aisles between equipment should allow easy access to and removal of large format items.
- suitably-sized tables should be located adjacent to the storage cabinets, so that staff can comfortably and safely check the contents of map folders and retrieve individual items.

Large format records should be stored in the conditions recommended for paper documents and artworks.

If specialised storage is available then temperatures between 18 to 20 °C and at relative humidity between 45 to 50 per cent are desirable. Office air-conditioning generally operates between 21 to 23 °C in temperate climates. If these conditions are

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stable then the natural deterioration of the objects can be moderated. Wide fluctuations in conditions can physically stress records and accelerate their deterioration. Note that air-conditioning systems often only operate during office hours, leading to a wider fluctuation of temperature and relative humidity at other times. At sustained relative humidities over about 65 per cent, mould growth can occur. It is recommended that you aim for a storage area with stable conditions, where the temperature is around 20 °C and the relative humidity remains below 60 per cent. Materials degrade faster when exposed to ultraviolet (UV) light. Fluorescent tubes which are low in UV should be used wherever possible in storage areas. Ultraviolet light can be easily measured with a light meter, and levels should not exceed 75 µW/lumen. Lights should be turned off whenever possible. Storage areas should not have windows, but if they do they should be covered with curtains or blinds.

Insects and rodents once attracted to a record storage area may start eating the records. To reduce the risk of infestation:

- don't allow food to be eaten in storage areas
- keep floors, shelves and shelf tops clean
- bait regularly for rodents and fumigate annually for insects, but only fumigate if an infestation is found
- use sticky traps to monitor for infestation and insect type.

Copy maps and plans with a large-format plan copier or scanner with a flat transport path that won't curl the record around a roller. Fragile or damaged records should be encapsulated before copying in purpose designed polyester sleeves.

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## Appendix Two

### E) Photographs

The following is based on the guidance published by the National Archives of Australia.

#### What is a photograph?

A photograph is an image that is created by the action of light on a photosensitive paper or plastic substrate. Black-and-white images are formed by minute silver particles in a gelatin emulsion layer and colour images are formed by organic dye layers.

#### Prints

Traditional fibre-based photographic prints were based on high quality, pure cellulose papers and are considered to be an archival format. From the 1960s resin-coated paper (RC) prints were introduced because they could be quickly processed by hand or machine, but are not regarded as archival.

#### Negatives and transparencies

Photographic negatives and transparencies, (positive images) can be black and white or colour. Like other photographic formats they have a gelatin image layer.

Negatives are used to print positive images on photographic paper. They found in a range of sizes, the most common are: 35 mm, (miniature) and 6 cm (medium format) roll film; 4" x 5" (102 x 127 mm) and even bigger large format sheet film. Negatives were also produced on a glass base. These will most likely have been produced between the late 1890s and the 1950s.

Transparencies have a positive image and can be viewed directly or through a projector. They are usually colour images (35 mm slides) but can also be black-and-white (glass lantern slides) Transparencies can also be used to produce photographic prints.

#### Types of materials

Photography was commercially introduced in 1839. The earliest processes likely to be found in collections are daguerreotypes - mercury/silver image on silver-plated copper

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plate (1840s), ambrotypes – silver image on glass plate and albumen print – silver image on fine artist's papers (1850s).

Commercial colour processes date from the beginning of the 20th Century. However, it is likely the earliest colour photographs found in collections will be from the 1930s.

## 1. Preservation and storage

Photographs are prone to various types of deterioration that can affect both the image and support layers. The prime causes of deterioration in photographic materials are poor processing, atmospheric pollutants, physical fragility and chemical instability.

- if chemicals are not thoroughly washed out during photographic image processing, then the residues can cause staining, darkening or fading over time. With good storage this deterioration will usually slow and it is advisable to create a copy when image deterioration is noted.
- pollutants can cause image discolouration and staining.
- generally, photographic materials should be held carefully by the edges. Glass supports can break if dropped and embrittle over time. Paper supports will tear and film negatives are prone to chemical deterioration. The image layer should never be touched with bare hands.
- black-and-white albumen prints will fade over time, particularly in high humidity.
- colour images change colour balance as they age. This is because one or more of the dyes that form the image becomes colourless. For example, colour images from the 1970s often appear orange, because the blue dye is starting to disappear.
- in early resin-coated paper prints the polyethylene layer on the front and back of the photo may form an irreversible network of cracks.
- decorative cardboard mounts and album pages can yellow with age and stain photographic paper. They can also become brittle and if they break, the print is likely to break as well.
- cellulose nitrate and cellulose acetate film-base plastics are also inherently unstable.

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- while we cannot stop inherent deterioration – with good storage packaging and environments we can influence how fast it happens.

Cellulose nitrate and acetate films deteriorate irreversibly over time. Copying photographic images is a standard preservation strategy. However, where copying programs are not readily available, specialised low temperature and relative humidity storage will significantly slow deterioration and 'buy time'.

### **Nitrate film**

Nitrate film was the first successful plastic film base, and was used widely from its introduction in 1889 until the early 1950s for motion picture and still film negatives. It has widely varying stability and is highly flammable. When cellulose nitrate deteriorates it releases distinct acrid vapours (nitrogen oxides) that are corrosive to various materials and a human health risk. The film sheet will deform and the surface can develop a greasy quality. In later stages dark yellow/brown staining develops, the film becomes sticky and the image bleaches out. The film finally disintegrates. Tightly wound motion picture film seems to deteriorate more readily.

### **Cellulose acetate film**

Although cellulose acetate 'safety' film, was available in various forms from the 1920s it did not replace the unstable nitrate film base until the early 1950s. It is still used today for motion picture and still film negatives.

As acetate film deteriorates it releases acetic acid that gives it a vinegar smell (known as 'vinegar syndrome'). As deterioration progresses the film base shrinks and becomes brittle, eventually the emulsion layer buckles and separates from the base. It can also develop bubbles under the emulsion layer and white crystalline deposits on the surface. Ideally, both nitrate and acetate negatives should be kept isolated from other collection material because of the damaging vapours they produce. Additionally, there are regulations that restrict the quantity of nitrate film that can be stored at a single location because of its flammability.

### **Storage**

Ideally, agencies or institutions should store photographic collections in a dedicated

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space:

- a storage area with stable climate control is recommended for important collections.
- when these conditions can't be maintained, aim for a stable environment and avoid high temperature and humidity levels. A cupboard in an internal room that does not contact external walls can help the buffer photographic records from daily temperature and humidity fluctuations. Lower floor levels in a building are usually cooler and more stable than upper levels. However, avoid damp areas such as basements.
- packaging will protect photographic materials from light and dust.
- turn off the lighting whenever storage areas are unoccupied.
- keep storage and work areas clean and free of food and drink.
- inspect the storage area regularly for insects, water leaks, structural damage or other events that may threaten the collection.

## 2. Handling and care

The following basic points should be kept in mind when handling photographic material:

- paper bases can be creased, folded or torn when in good condition and are even more vulnerable when they deteriorate.
- photographic material should be handled where possible in its protective enclosure. If it must be removed then it should be handled with great care by the edges. Clean disposable cotton or surgical-type gloves may be used. Fingerprints will corrode the silver in black-and-white images and cause colour dyes to change colour.
- don't apply identification labels or stamps directly to photographic material. Identification should be on the packaging or a piece of archival paper slipped into a sleeve/envelope with the photograph.
- pencil or an appropriate pigment pen can be used on the non-image border of slides. If an inscription must be written on a photograph, use a soft (2B) graphite pencil along an edge on the back of the print. Write on a firm surface with light pressure to avoid indentations in the paper. Pencil does not write well on resin-coated papers, so it is advisable to use a pen with permanent pigment-based ink only on the back, along one edge. Do not stack prints

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before the ink has completely dried, otherwise it can transfer to the front of an adjacent photograph and be very difficult to remove.

- never use metal pins, staples, paper clips, rubber bands or adhesive tape to secure photographic materials. Do not try to remove tapes and labels adhered to photographic materials without conservation advice. Removal may cause damage. Only remove rubber bands and metal fasteners when it can be done without damage.
- photographic material should always be handled in a clean work environment and all viewing equipment should be well-maintained.

The way a collection is used should determine the type of enclosure. If the material is going to be regularly accessed, clear plastic enclosures allow the photographs to be viewed without removing them from their sleeve. If the collection is infrequently accessed, paper envelopes may be the best choice as they act as a buffer for the photographic item.

Polyester is the most stable plastic for photographic storage. Polypropylene (PP) is a low cost and readily available alternative. Never use polyvinyl chloride (PVC) sleeves and folders.

Use paper envelopes that are known to be safe for photographic materials. Some archives carry out a test known as the Photographic Activity Test (PAT) to determine the suitability of materials for the storage of photographs. Photographic collections require higher quality paper than paper-based collections: 'acid-free' does not necessarily mean 'photo-safe'.

Never use 'magnetic' self-adhesive albums because, over time they can cause severe damage to your precious photographs.

If photographs are stored in a display album ensure that it is manufactured from 'photo-safe' materials. The National Archives tested a number of commercially available albums and found them acceptable for storage of photographic materials. For specific information see the photographic activity test.

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Colour photographic slides can be stored in their original plastic boxes. Otherwise, they can be stored in archival quality slide storage pages available from photographic retailers and conservation suppliers. Slide storage pages should have passed the photographic activity test.

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## Appendix Two

### F) Microforms

The following is based on the guidance published by the National Archives of Australia.

Despite advances in digital technology, Microforms - microfiche and microfilms, are still a useful record format. They are directly readable (with magnification). Microfilms enable, and control access, (limited by the number of copies and access locations). They provide adequate information content where black and white/greyscale images are sufficient.

Microfilming is the production of reduced images of documents by photographic processes. There are three main formats:

- microfilm is usually 35 mm or 16 mm non-perforated film which can be presented as strips, rolls or cassettes. Black and white is most common, but colour is possible.
- microfiche is sheet film, usually 105 x 148 mm, incorporating multiple images – it is usually monochromatic.
- aperture cards, also known as image cards, consist of single 35 mm film frames mounted onto cards. This format is often used for reproducing architectural or engineering drawings.

There are three film composition types generally used for microforms:

- silver gelatin or silver halide film is composed of silver salts in a gelatin emulsion on polyester film base. This is preferred as the preservation master because, when correctly processed it has excellent stability and image quality. The image is black and white.
- diazo film incorporates light-sensitive diazonium salts in an emulsion. The image is usually deep blue to black and white, with medium to high resolution and available in all formats. The resilient outer surface of this film is less susceptible to scratching than silver halide film, making it very suitable for reference copies. However, it is chemically less stable and not suitable for long-term retention.

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- vesicular film uses diazonium salts but the image is produced by tiny bubbles formed in a polymer layer when the film is exposed to ultraviolet light. It is popular because it allows the production of quick and easy client copies. The resolution quality is less than diazo and silver halide, the image colour is in the pink to purple range, and all formats are available. It is normally used for reference copies or material for short-term retention, as the inherent instability of this film makes it unsuitable for archival filming.

When film is being produced to create a permanent record, most standards and guidelines recommend that three copies be produced: a preservation master on silver halide film, a duplicating master (also silver halide) from which subsequent copies are made, and a set of as many reference or working copies as required (usually on diazo or vesicular film). The minimum acceptable requirement for archival purposes is one master and one reference copy.

## 1. Preservation and storage

As noted above materials are susceptible to deterioration because of their properties and degrade over time. However, by controlling storage environments, we can control how fast it happens. Microforms are produced on photographic film and share the same deterioration characteristics as other photographic media.

- microfilming technology predates the 1930s and very old microfilm may be on acetate or nitrate-based film, which has particular preservation problems.
- some vesicular films produced in the 1960s and 70s were extremely unstable, resulting in severe image loss and liberating chlorine gas which can cause degradation of other records stored nearby.
- diazo and vesicular films can be particularly sensitive to high temperatures, affecting image quality.
- film which has been poorly processed or exposed to chemical pollutants in storage often develops a type of staining known as 'redox blemishes'. These are small deposits of metallic silver which interfere with image legibility.
- microforms can be damaged by poor handling practices and exposure to dust that can affect image quality and promote mould growth. Like most other photographic images, microforms are also light sensitive.

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Correct handling of microforms will aid in preserving them for the long-term:

- handle with care.
- clean lint-free cotton gloves should be used at all times when handling silver halide film.
- silver halide master films should not be used for reference purposes as the film rolling mechanisms on the reader and printer equipment can severely scratch the gelatin emulsion.
- regular surveys of the film holdings should be programmed to detect problems, including the development of redox blemishes.
- reference films should not be left in viewing equipment as prolonged light exposure will affect image quality.
- films and fiche should be returned to their protective packaging immediately after use. Do not leave microform material loose on a work surface.
- viewing equipment should be maintained and the work environment clean.

The method of packaging microforms will depend on the exact material and the use for which it is required. Master films should always be stored in archival quality enclosures to ensure their long-term stability. Reference copies may not require such stringent quality controls. The method of packaging will also depend on the specific format.

### **Microfilm**

- microfilm should be wound onto inert standard-sized plastic or corrosion-resistant metal reels. The loose end of the film should be secured using a strip of paper that has passed the photographic activity test, (PAT) held in place with cotton tape. Never use rubber bands or sticky tape to secure a film.
- each roll of film should be individually enclosed in close-sealing containers made from polypropylene, or cardboard that has passed the photographic activity test, (PAT). The size of the container should fit the size of the film, ie do not put small rolls of film in large containers.
- never apply labels directly to the film – mark the outside of the container , preferably with permanent inks.

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## Microfiche

- master microfiche should be individually enclosed in sleeves or envelopes made of inert plastics such as polyethylene, polypropylene, polyester or Tyvek, or paper that has passed the photographic activity test, (PAT).
- reference copies of fiche may be stored, in plastic file boxes or drawers as long as they are protected from dust and light.
- do not apply labels directly to fiche or individual enclosures. Each fiche has a header where control information is recorded. However, use a permanent pen and mark the non-image area of the fiche if additional information is required.

## Aperture cards

- aperture cards are normally only produced for reference purposes and can be stored in clean sturdy containers that exclude light and dust. The master copy would normally be retained as a roll film. However, if master aperture cards are held they should be individually enclosed, in the same way as master microfiche.

The preservation master copy of any fiche or film should be kept in a different location to the duplicating master and reference copies. This should preferably be off site, even in another agency or state. This is a security measure to ensure that at least one copy of the information will always exist, protecting the master against destruction by theft, inadvertent use, or disaster such as flood or fire.

Storage furniture should be made of coated metal. Wood should be avoided, as it can release harmful vapours, can contribute to the spread of fire and may harbour insects. Specially designed storage furniture such as drawers and cabinets can be purchased for microforms allowing more efficient use of space, however, these are only necessary when large quantities of film are held.

Preservation and duplicating masters should be stored in a clean, dark, climate-controlled environment. Black-and-white material should be kept at 8 to 12 °C and 30 to 40 per cent relative humidity, and colour at less than 5 °C and 30 to 40 per cent relative humidity. Temporary records and reference copies can be stored under general archives standards of 18 to 22 °C and 45 to 55 per cent relative humidity.

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Microforms degrade more quickly when exposed to ultraviolet (UV) light. Fluorescent tubes which are low in UV should be used wherever possible in storage areas. Ultraviolet light can be easily measured with a light meter, and levels should not exceed 75 µW/lumen. Lights should be turned off whenever possible. Storage areas should not have windows, but if they do they should be covered with curtains or blinds.

Insects and rodents once attracted to a records storage area may start eating the records. To reduce the risk of infestation:

- do not eat in storage areas.
- keep surfaces (floors, tops of shelves) clean.
- bait regularly for rodents and fumigate annually for insects.

It is important to select the correct format and film type to suit the purpose for which the microform is required and the nature of the original record being reproduced. Take care that the filming process does not cause unnecessary damage to fragile or valuable originals. For this reason manual filming is preferable to automated filming.

Production standards are especially critical where microfilm is being produced to replace an original record that is inherently unstable and cannot be preserved. Preservation microfilming production standards encompass quality control issues such as document control, targets, camera settings, and post-production checks on image quality and chemical stability. Silver halide microforms produced and stored according to these standards are predicted to have a life expectancy of 500 to 1000 years, which very few record formats can match. However, films not produced to these standards may be severely degraded after as little as 20 years.

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## Appendix Two

### G) Motion Picture Film

The following is based on the guidance published by the National Archives of Australia.

Motion picture film consists of a clear plastic base coated with a thin layer of gelatin. This layer contains an image made from colour dyes, or in black and white film, very small particles of silver. Film also comes in a range of widths or 'gauges': 35 mm and 16 mm are professional formats and 8 mm is usually a domestic format. Historically, there are three common types of film base: cellulose nitrate, cellulose acetate and polyester.

- cellulose nitrate-based motion picture film was widely used by filmmakers until the early 1950s, but is highly flammable.
- cellulose acetate *safety* film base was used from the 1950s. It can be identified by the words, safety film imprinted on the film edge.
- polyester-based motion picture film used widely in picture theatres to project films because of its strength and durability.

A number of different components are created to make a motion picture film and include: camera negative and reversal (positive) films; magnetic film soundtracks; optical soundtracks; projection or release prints with optical soundtrack stripes along the film edge.

#### 1. Deterioration

All materials deteriorate over time and although it is inevitable, correct handling and care can slow it down.

Motion picture film is at risk of three types of deterioration: chemical decomposition, mechanical damage and biological degradation. The plastics used to make motion picture film are at risk from different types of chemical deterioration.

- cellulose nitrate film is very unstable. It can react with moisture in the air to form nitric acid. As nitrate film deteriorates it develops a sticky or greasy surface, a

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dark yellow or brown all-over staining and a bitter or acrid smell. It can self-ignite if stored in a hot, humid environment and may be almost impossible to extinguish once it starts to burn.

- cellulose triacetate film is vulnerable to 'vinegar syndrome', where the plastic reacts with water in the air to form acetic acid. This produces a vinegar smell, which gives the reaction its name. Vinegar syndrome-affected film shrinks, distorts so that the film will not lie flat. Extremely degraded film often develops a white powder on the edges. The image layer can crack and appear fragmented. Eventually, the film layers can stick together and become blocked. Once film reaches this stage there is no practical way to repair it.
- polyester film is mechanically tough and chemically stable. However, the gelatin image layer is still susceptible to scratching and to the effects of mould.

## 2. Health and safety risks

Care should be taken when handling degraded nitrate and acetate -based film because both pose a health and safety threat. Nitrate-based film is highly flammable and classified as a hazardous material. It has an acrid smell when deteriorating and must be stored separately from other collection materials in a designated area that firefighters can identify. Vinegar syndrome affected acetate film has a characteristic smell of acetic acid. Exposure to these fumes can cause throat, eye and skin irritations. If you are aware of these odours leave the films in their closed canisters.

## 3. Preservation and storage

Motion picture film is fragile and must be handled with care to extend its useful life.

- handle film by the edges, and avoid touching the emulsion which is easily damaged.
- return films to their protective packaging when finished using them.
- to minimise the possibility of mechanical damage, ensure that all playback and recording equipment is clean and in good working order before using it. If you are unsure how to use replay equipment contact the Agency Service Centre.

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- a roll of film should be wound tightly enough so that it doesn't unravel, yet loose enough to allow some airflow. This will minimise the risk of film *blocking* due to vinegar syndrome.
- store film in clean canisters to protect them from dust, dirt, pests and other contaminants. Plastic canisters are generally preferred to steel film canisters which are prone to rust.
- ensure that film is free from dust, mould and other contaminants before enclosing it.
- a roll of film should be wound evenly onto a reel or core so that when it is stored in a film can it will be as flat as possible. The end should be secured with archival hold-down tape.
- label every film can clearly and prominently for easy identification and to reduce handling.

Motion picture film is at particular risk of damage when being projected.

- mishandling during winding or projection can tear film and cause old splices to fail.
- improper film threading for projection can result in perforation damage.
- contact with dirt or other contaminants can permanently scratch film.

#### 4. Storage

Good film storage is the primary strategy for preservation.

Warm and humid conditions, as well as changing temperature and relative humidity levels can accelerate chemical deterioration and encourage mould growth. Mould can cause serious damage to both image and base emulsion layers of motion picture film. The colour dyes in film are likely to fade over time, especially when exposed to light, heat and humidity. Therefore, it's very important to store motion picture film in cool, dry and stable conditions to slow deterioration. Lights should be turned off when the storage area is not in use. If storage areas have windows they should be covered with curtains or blinds to eliminate light and reduce heating effects.

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- store motion picture film horizontally on powder-coated steel or wooden shelves, with an inert coating.
- do not stack film cans more than five high and preferably less if they are 35mm films.
- do not eat or leave food in storage areas as this can attract pests.
- the lowest shelves should be 15cm off the floor in case of minor flooding.
- films should not be stored on the top of shelving units where they will be exposed to dust and the possibility of water damage from roof leaks.

Important and frequently used films should be digitised for preservation and reference purposes.

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## Appendix Two

### H) CDs and DVDs

The following is based on the guidance published by the National Archives of Australia.

The term 'optical disk' describes a range of disk types where the stored information is read by a laser.

There are three main types of optical disk:

- CD-ROM, (read-only memory) and DVD-ROM disks contain information that cannot be changed or added to by the user. On ROM disks, data is moulded as pits in the polycarbonate layer. A top metal layer usually aluminium, silver or gold reflects the laser.
- CD-R (recordable) disks are blank when sold. While a region of the disk can only be recorded once, additional files can be recorded in different regions until the disc space is filled. Recordable disks use a photosensitive dye layer sandwiched between the polycarbonate and metal layers to capture and store data. Recording onto the disks requires dedicated hardware and software.
- Rewritable optical disks, (CD-RW and DVD-RW) allow the user to record information on a disk, erase it, and replace it with new data. Rewritable disks have a phase-changing film between the polycarbonate and metal layers. To erase and rewrite data, the laser beam heats the film, changing its light transmission properties. They are used when information is being regularly revised, edited or updated. CD-RW disks also require dedicated hardware and software.

DVDs have a composite construction with the data stored between two layers of polycarbonate in the centre of the disk.

## 2. Preservation and storage

CDs and DVDs are not suitable for long term archival use. Data is stored on Optical disks in the form of marks or pits that either absorb or reflect the light from a laser beam. The

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disks have a plastic and metal layered construction that makes them susceptible to damage. Information is stored very densely on optical disks and minor damage or deterioration can cause significant information loss.

There are many sources of potential damage to disks:

- solvents can affect the Disk lacquer and subsequently the metal layer.
- damage to the polycarbonate plastic layer is a common cause of optical disk failure. Because they are read optically, anything that interferes with the light path can cause skipping or repetition of tracks. Fingerprints or other surface deposits may cause etching of the plastic and result in irreversible damage. Handle disks by the outer edge or the centre hole only, do not touch the surface of the disk.
- the polycarbonate has a tendency to 'flow' over time. The plastic layers may slowly distort and become difficult to read.
- the 'label'-side of disks are particularly prone to damage by writing implements. Pressure from pen nibs on the lacquer and metal layers can make the disk unreadable. Inks used to print information on the label surface may corrode the plastic or lacquer layer and subsequently the metal layer. Writing on the clear center area of the disk with a *CD marking pen* can avoid this problem.
- heat and humidity and sudden changes in temperature can cause degradation.
- corrosion of the metal information carrying layer can make a disk unreadable. Certain metals, such as gold, are more resistant to corrosion than others.

It is possible to clean a dusty or dirty optical disk before permanent damage occurs. Gently remove loose dust with a non-abrasive photographic lens tissue, or very soft brush. CD/DVD-cleaning cleaners can be used. Follow the directions to remove oil and dirt deposits.

The cleaning motion should never be circular. Always brush radially from the centre of the disk outwards.

Optical disks are normally housed in a rigid plastic jewel case. These cases are

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reasonably dustproof and minimise the effects of environmental change. They are usually made of an inert plastic and are suitable for long-term storage. Disks that do not have a jewel case should be individually enclosed in an inert plastic sleeve, made of polyethylene, polypropylene or Tyvek. Store disks upright in cases designed for CDs and DVDs. Jewel cases are the ideal enclosure because they support each disk at the hub and protect them from impact.

Open a recordable disk package only when you are ready to record data onto it. Check the disk surface before recording to make sure that it is clean and in good condition. Return a disk to its packaging immediately after use. Do not bend or flex disks. Do not use adhesive labels on a disk as the adhesive can cause damage. Do not expose disks, to sunlight or other sources of ultraviolet light.

Optical disks are not regarded as long-term archival media. However, a lower temperature and relative humidity will slow their natural deterioration.

Technological obsolescence is a major factor that threatens long-term use of optical disks. CDs made today can be in excellent condition in 30 years. But the data may be inaccessible if the hardware to play them or the software to interpret them has been superseded. The cost of recovering data from obsolete media and data formats is likely to be high and time consuming. It is essential to have a timely plan to migrate data from optical disks onto newer media.

The best prospect for long-term retention of information on optical disks seems to be regular copying or data migration. Two solutions are to upgrade the data to current formats when you migrate the data to new media or use open source data formats.

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## Appendix Two

### i) Magnetic Media

The following is based on the guidance published by the National Archives of Australia.

The term 'magnetic media' is used to describe any record format where analogue or digital information is recorded to and retrieved from a coated matrix that can be magnetised.

Common types of magnetic media are:

- audio reel-to-reel and cassettes tapes
- video and computer tapes on open reels or in cassettes
- hard disk drives, (HDD)
- floppy disks or diskettes.

Magnetic tape has a plastic carrier coated with a matrix of metal or metal oxide particles, a resin binder and other ingredients such as lubricants and fungicides. Sometimes the tape has an antistatic coating on the back to reduce static charge build-up and to improve its winding capability.

Magnetic hard disks usually have an aluminium base, coated on both sides with a metal or metal oxide matrix. They have wide application in computing as the principle storage medium. Floppy disks and diskettes consist of a plastic base with a magnetic matrix on one or both sides. They are enclosed in a rigid, plastic protective jacket. Although an obsolete medium they are still likely to be found in collections and are a priority for transfer to new media.

## 2. Preservation and storage

All materials degrade at different rates over time. We cannot prevent this inevitable deterioration, but we can slow it down. Below are examples of the types of deterioration to which magnetic media are prone.

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- older acetate audio tapes can become brittle and easily broken. The magnetic coating on tapes and disks can deteriorate and subsequently flake off the base.
- print-through, which is the transfer of a signal from one loop of tape onto an adjacent loop. This takes the form of a pre-echo and can be obviated by storing audio tapes 'tail-out' on their reels.
- high temperature and humidity and fluctuations may cause the magnetic and base layers in a reel of tape to separate, or cause adjacent loops to block together. High temperatures may also weaken the magnetic signal, and ultimately de-magnetise the magnetic layer.
- tapes are particularly susceptible to mould because pockets of air trapped in the windings can create microclimates which will support mould growth.
- dust, dirt, grease and chemical pollutants can promote moisture condensation and oxidative deterioration. These contaminants also interfere with the contact between the playback head and the tape, causing audio signal drop-outs.

Magnets or magnetic fields can cause information loss on a tape or disk if it is in close proximity for long enough because information is encoded on magnetic media by the alignment of magnetic particles. The degree of risk depends on a number of factors; proximity of the media to the source of the field; strength of the field, and duration of exposure. Running a vacuum cleaner past the shelves will probably not cause any damage, because magnetic effects decrease with distance.

- always handle magnetic media as carefully as possible.
- pick up magnetic tapes by their protective cases – do not touch the tape or disk surface.
- wear lint-free gloves or ensure that hands are clean and dry.
- support open-reel tapes by the hub during handling and transportation.
- disks should never be flexed, bent or picked up by the oval slot in their jackets, or by the centre hole of the disk.
- labelling should be in ink rather than pencil, as graphite dust from the pencil could interfere with the reading of the disk or tape. Once applied, labels

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should not be written on, and should only be attached to a protective case, rather than directly onto the magnetic tape or disk.

- only remove items from their protective packaging for immediate use, and return them to their containers directly after use.
- audio cassettes and open reel tapes should be wound to the end of one side after use and not left in a partly wound state for any length of time. Avoid use of the 'pause' mode with audio and video cassettes.
- when moving magnetic media ensure that it is properly packed in custom-made transportation canisters and is not bumped or dropped. Consult specialist freight and courier companies when transporting large quantities of magnetic media.

Magnetic media is sometimes supplied in cardboard enclosures. These can be used for the storage when in good condition. However, when they are older or damaged, they tend to generate dust.

Tapes should be stored in cases made of non-magnetisable material, preferably an inert plastic such as polypropylene. Cases should have internal lugs to securely hold the tapes by the hub. They should be strong enough to protect the cassettes from external damage and close tightly to keep out dust.

Reels or cores used for winding tapes should be clean and undamaged. Reels should be made of aluminium or a stable inert plastic.

Floppy disks and diskettes should be stored in protective envelopes that have a non-abrasive surface and are resistant to the build-up of static electricity. Tyvek envelopes are widely available and are suitable for this purpose.

Storage areas should be free from potential sources of dust, such as paper shredders, printers and carpet. Measures, such as the installation of an air-lock, or the maintenance of positive internal air pressure, can be taken to prevent dust entering from the outside.

Magnetic media should ideally be stored in closed metal cabinets to provide extra protection against heat and dust. However, if adequate environmental controls are in

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place, storage on open shelves, in their cases is acceptable. Storage equipment should be sturdy, allow tapes and disks to be stored vertically, and most importantly, be electrically grounded.

Turn off lights in storage areas when not in use to minimise the exposure of records. An ideal storage area would have no windows, but if windows are present they should be covered with curtains or blinds.

Cleanliness is very important in storage areas, for reasons of records protection and, work health and safety. Never allow food or drink to be taken into a records storage area, and ensure the area is cleaned regularly. Insects and rodents, once attracted to a records storage area by food, may begin to eat the records.

It is essential that recording and replay equipment for magnetic tapes is maintained in good condition because information held on magnetic media is mechanically processed. Poorly maintained equipment can damage records. The heads, disk drive and tape drive elements of playback and recording equipment should be cleaned regularly in accordance with the manufacturers' recommendations.

To minimise deterioration due to handling and use, copies of important and frequently used tapes should be made for reference purposes. Ideally, a preservation master copy, a duplicating copy and a reference copy should be produced, and clearly labelled as such. As a disaster preparedness measure, the preservation master copy should be stored in a different location to the others. The duplicating copy may be used to produce further reference copies when required.

Long-term preservation of magnetic media is affected by two major factors; its intrinsic instability and the likelihood of the hardware obsolescence. The equipment used to access magnetic media today will almost certainly have been superseded in the next decades. For all practical purposes the records will be unusable, even media in good condition. The main prospect for long-term retention of the information held on magnetic media seems to be in regular copying or data migration, thus maintaining a good quality signal that can be read using available equipment. Copying can either be to fresh tape or disk, or to some other machine-readable format. Once copied to an

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uncompressed digital format the information can be copied without loss of quality.

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## Appendix Two

### J) Gramophone Records

The following is based on the guidance published by the National Archives of Australia.

Gramophone discs developed in the late 19th Century became the dominant form of domestic audio in the 20th Century. There are three main disc types; shellac based, (78s); acetate coated metal or glass transcription discs and vinyl long-play, (LP) discs. During the second half of the 20th Century virtually all gramophone discs were Vinyl LPs and seven inch'45s'. Technically, the discs have a single modulated groove that generally spirals from the edge of the disc to the centre. The encoded information in the groove is reproduced using a stylus and amplification. Digital compact discs were commercially introduced in the early 1980s and signalled the beginning of digital audio in the home. Despite the current predominance of digital recording and reproduction, vinyl discs have been resurgent in the past decade or so and are, along with analogue turntables, still commercially available.

#### Composition of discs

All materials degrade over time. We cannot control this inevitable deterioration, but we can control how fast it happens. Certain materials are susceptible to deterioration in particular ways just because of their properties, and other materials deteriorate as a result of particular environmental conditions. For example:

- shellac discs are relatively brittle and can shatter if dropped. The use of heavy steel styli to reproduce the recorded sound caused rapid disc groove wear.
- instantaneous recording discs consist of a very thin layer of cellulose nitrate or acetate over a metal substrate. As the plastic degrades, it shrinks, causing cracking of this layer. This makes the disc unplayable.
- the PVC/PVA copolymer used for vinyl discs includes stabilising compounds that has given them a relatively long useful life. The mechanical reproduction with a stylus also causes wear over time. Vinyl discs will readily buckle if exposed to heat or sunlight.

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## 1. Preservation and storage

Gramophone discs should last as long as required with careful handling and storage:

- handle the disc by the edges and central label only.
- use clean hands and disposable nitrile gloves
- use the correct equipment when playing gramophone discs, to prolong their useable life. The disc should be clean and free from dust before playing. The stylus should be in good condition and set at the correct weight, (3g – 7g).
- when not in use, discs should be stored in a protective sleeve that excludes dust and dirt.
- archival quality materials should always be used when packaging archival records.
- if packaging a broken disc, make sure the edges of the disc do not touch as movement can cause further damage. Do not discard any pieces and ensure that they are kept together. This is particularly important for 'acetate' discs that have flaking coatings.
- do not apply labels directly to gramophone discs. Label the protective sleeve with any additional necessary identifying information.
- make sure the box is not too big or too small, and the box is not too full or too empty, as both instances can cause damage.
- gramophone discs should be stored upright on shelves.
- boxes or shelf dividers should provide support so that the discs do not lean over at an angle while on the shelves.
- because shellac discs are brittle store them on static rather than mobile shelving to reduce the chance of them falling from the shelf.
- ensure that the disc is clean, free of dust, unaffected by mould or active corrosion, before placing it in protective packaging. If affected items are identified, then isolate them and seek preservation advice through the Agency Service Centre.

Lights should be turned off whenever possible. Storage areas should not have windows, but if they do they should be covered with curtains or blinds.

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Cleanliness is very important in storage areas to protect records and for work health and safety. Never allow food or drink to be taken into a records storage area, and ensure the area is cleaned regularly. Insects and rodents, once attracted to a records storage area by food, may begin to eat the records.

Storage equipment should be designed and set out to minimise damage to any items that are stored within it:

- store items off the floor in case of flood. Plinths or pallets may be used to do this if the item will not fit into shelving.
- equipment should be made of coated metal. Wooden shelving should be avoided, as it can release harmful vapours, contribute to the spread of fire and may harbour insects.
- items should not be stored on the top of shelving as they may be too close to ceiling lights and there is also the possibility of water damage from fire sprinklers.
- aisles between equipment should allow easy access to and removal of items.
- suitably sized tables should be located next to the storage cabinets; this will provide a place for staff to comfortably and safely check the contents of boxes and drawers and retrieve individual items.
- gramophone discs, particularly non-commercial and transcription discs can contain unique information content that should be preserved. Copying to an uncompressed digital format is an important conservation and access process. Discs should be copied by a skilled professional on high quality equipment. Please contact your local National Archives of Australia office if you are considering copying your gramophone discs for preservation reasons.

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# Appendix Two

## K) Objects

The following is based on the guidance published by the National Archives of Australia.

Objects held in archival collections may include:

- sculptures, statues
- large and small decorative or functional items – chandeliers, plaques, vases, jewellery, furniture, trophies, keys, seals, rubber stamps, dinnerware and typewriters
- natural history objects – geological samples, anthropological collections and zoological specimens
- textiles – stuffed toys, rugs, embroidered items, lace, tapestries, clothing and uniforms
- scale models of ships, buildings, cars, and landscapes.

Objects are often composed of more than one material. For example: a clock case could be made of wood, contain the metal movement and have a glass cover. The clock case may also be varnished, painted or coloured in some manner.

### 1. Preservation and storage

All materials degrade over time. Some deteriorate because of their inherent properties, others as a result of poor storage or display conditions. We can't stop it but we can control how fast it happens.

- wood can crack and warp under different climatic conditions.
- textiles, fur and leather are susceptible to mould growth and insect attack in humid conditions.
- coloured textiles are subject to fading when exposed to light.
- plastics gradually become brittle as they lose their plasticisers and other additives.
- over time bone and ivory can become brittle and discolour.
- metals corrode as humidity rises.

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When handling:

- carry single items carefully, one at a time.
- ask for assistance or use a trolley when moving large or heavy items.
- wear disposable nitrile gloves, or ensure your hands are clean and dry.

Gently clean objects only with a dry soft cloth or brush. If objects need repair or extensive cleaning seek professional advice through the Agency Service Centre.

Ensure that an object is free of dust and not affected by mould, insects or active corrosion before placing it in protective packaging. Affected items should be isolated from other objects. Seek advice on dealing with them through the Agency Service Centre.

Objects are often non-standard in size and shape, and require custom made packaging and storage shelving.

Here are some guidelines when packaging objects:

- wrap objects individually so they don't touch and damage each other.
- use suitable shock-absorbing packaging materials like acid-free tissue, archival foams or bubble pack. Do not use newspaper.
- do not write or stick things directly onto the object. Label the box clearly and if practical, tie a label onto the object with cotton tape.
- use archival boxes. These are available commercially in both standard and custom-made sizes.
- make sure the box is big enough to fully enclose the object with protective padding, but not so large that the object is free to move and be damaged.
- if the object is too big to box, drape it with cotton dustsheets.
- objects should be transported in their protective packaging.

Textiles should be handled differently from most other objects. They should be laid out flat in a box and interleaved with archival, acid-free tissue paper. Folds in the textile should be padded out with a sausage-shaped roll of tissue. Take care not to crush textiles and remember that old textiles can be very fragile.

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If specialised storage is available then temperatures between 18 to 20 °C at a relative humidity between 45 to 50 per cent are desirable. Office air-conditioning generally operates between 21 to 23 °C in temperate climates. If these conditions are stable then the natural deterioration of the objects can be moderated. Wide fluctuations in conditions can physically stress records and accelerate their deterioration. Note that air-conditioning systems often only operate during office hours, leading to a wider fluctuation of temperature and relative humidity at other times. At sustained relative humidities over about 65 per cent, mould growth can occur. It is recommended that you aim for a storage area with stable conditions, where the temperature is around 20 °C and the relative humidity remains below 60 per cent.

Materials degrade more quickly when exposed to light, especially ultraviolet (UV). Surprisingly, fluorescent tubes often emit a relatively high level of UV. Lighting should be turned on only when it is needed. Ideally, storage areas should have no windows. Where windows are present, they should be covered with opaque curtains or blinds.

Insects and rodents once attracted to a records storage area may start eating the records. To reduce the risk of infestation:

- do not eat in storage areas.
- keep surfaces (floors, tops of shelves) clean.
- bait regularly for rodents. Inspect for insects, but only fumigate if an infestation is found.
- insect blunder traps can be used as monitors for localised insect infestation.

Storage equipment should be designed and set out to minimise damage to any items that are stored within it.

- store items off the floor in case of flood. Plinths or plastic pallets may be used to do this if the item will not fit into shelving.
- equipment should be made of coated metal. Wooden equipment should be avoided, as it can release harmful vapours, contribute to the spread of fire and may harbour insects.

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- items should not be stored on the top of storage equipment. They will be too close to ceiling lights and there is also the possibility of water damage from fire sprinklers.
- aisles between equipment should allow for easy access to and removal of items.
- suitably sized tables should be located next to the storage cabinets, so that staff can comfortably and safely check the contents of boxes and drawers and retrieve individual items.

When objects are suitable for storage within drawers, the drawers should be clearly labelled with their contents so that items may be retrieved with a minimum of handling. To prevent damage to the objects when the drawers are opened and closed, the drawers should:

- operate smoothly
- have stops to prevent them from being pulled completely out when they are opened
- have a lip at the front to prevent items from falling onto the floor and at the back to prevent items from falling behind the drawers
- never be overfilled and ideally be only half-full or contain only one flat object, eg a textile object such as a dress.

Objects in archival collections are often unique and it can be difficult to produce facsimiles. Reference and evidentiary needs can often be satisfied with a good quality photographic image. Requirements for the safe display of objects vary with the composition of the object. Specialist advice should be sought before displaying objects of value.

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